

tion made by Mr. Howard Grant Jones, and published, under the title, *Notes on the Cumberland or Potomac Coal Basin*," in the Proceedings, No. 107, pages 111 to 116.

Professor P. E. Chase communicated a paper entitled "Photodynamic Notes, III," including "A Series of Natural Standard Units for gravitating, luminous, thermal, electric and chemical comparison."

Dr. George A. König communicated a paper "On *Alaskaite*, a new member of the series of bismuth sulpho salts," as a "contribution from the University of Pennsylvania."

Pending nominations Nos. 934 to 936 and new nominations Nos. 937 to 940 were read.

Permission was given the Librarian to permit Professor Richards, of the University of Pennsylvania, to take from the library three volumes of Bouillon for the purpose of photographing the engravings for his lectures.

The Secretaries were authorized to furnish Mr. Henry Phillips, Jr., one of the Curators, with a letter introductory to foreign correspondents of the Society.

And the meeting was adjourned.

*Notes on the Geology of West Virginia. By I. C. White, Professor of Natural History in the University of W. Va.*

(Read before the American Philosophical Society, June 17, 1881).

*A Rectification of the Section made by Mr. Howard Grant Jones, M.S., and Published under the Title of "Notes on the Cumberland or Potomac Coal Basin," in Proc. A. P. S., No. 107, pages 111-116.\**

The results at which Mr. Jones arrived concerning the duplication of No. XI along the North Potomac river, in his paper read before this Society last year, were so startling, and so much at variance from my own limited knowledge of the geological structure in that region, that I determined to investigate the question anew at the first opportunity. During May of the present year, in company with some members of my class in Geology at the University, we took a five days' excursion through the Piedmont Keyser region, and the present paper is the result.

As will be seen from the sequel, that part of Mr. Jones' section below No. XII is erroneous.

\* Read September 17th, 1880.

I find *no duplication of No. XI*, the "2000' red shale," which Mr. Jones placed in No. XI, being Catskill, separated from the true No. XI by 1150' of gray Pocono (Vespertine) (X) sandstone; his "440' Lower Mountain Limestone" is *Lower Helderberg* (No. VI); his "100' Pocono sandstone" is the *White Medina*, more than 10,000' below the true Pocono.

The line of section extends from Piedmont, Mineral county, West Virginia (and Westernport, Maryland, just opposite), south-eastward along the West Virginia side of the North Potomac, to Keyser (formerly New Creek), and one and a half miles beyond to the summit of Knobby mountain ("Knobbly").

A reference to the accompanying figure will explain the structure of the rocks along the section line which is not far from six and a half miles in length.

As is well known, the Cumberland, or Potomac Coal Basin, lies in a trough of the Allegheny system with Savage mountain bounding its north-western rim, and Dan's mountain\* its south-eastern. The North Potomac, after flowing north-eastward down this great syncline for many miles in West Virginia, receives the Savage river at Bloomington, near the Maryland line, whence the combined stream flows eastward across the Basin to Piedmont, two miles below, and then veering to the south-eastward cuts squarely through the Dan's Front Ridge mountain, continuing on across the upturned edges of X, IX, and VIII to Keyser, when trenching through an arch of VII, and the upper portion of VI, across New Creek mountain (ridge), it again flows north-eastward along the north-western slope of Knobby mountain to Cumberland.

From an inspection of the figure, it will be observed that the strata are almost horizontal in the vicinity of Piedmont, and Westernport; that in going south-eastward they soon begin to rise quite rapidly, the lowest beds of No. XII coming up to the south-east at an angle of  $12^{\circ}$ , three-fourths of a mile below Piedmont. Nos. XI, X, IX, and VIII come up successively with constantly steepening dips until near the middle of VIII, the rocks are vertical; finally near Keyser the Oriskany sandstone, No. VII, comes up with a diminished dip, and arching over the anticlinal axis of New Creek mountain, barely dips down to water level on the North Potomac, making a very shallow and sharp syncline, since it immediately returns with a reverse dip of  $65^{\circ}$  to the North-west, which carries No. VII, VI, and V into the air over the Walker's ridge anticlinal, one-half mile south-east, to come down again on a south-east dip in the monoclinical range of Knobby mountain, whose crest is formed by the *Oriskany sandstone* (No. VII), and the underlying cherty layers at the top of the Lower Helderberg (No. VI), the varying composition and unequal hardness of which give rise to the peculiar topography that has given name (Knobby) to the range.

A more general discussion of the data in this section is reserved for a

\*On the West Virginia side of the Potomac the continuation of this range is called the Allegheny Front Ridge.

future paper. The intervals in the following section were measured directly down to 700' below top of the Mauch Chunk red shale, with one of Hick's compensated aneroids, the rest of the section being obtained by calculation from the observed dips and measured horizontal distances. The thicknesses thus arrived at are deemed rather under than above the truth, since a small percentage of error must necessarily enter into the construction of every such section.

1. Massive sandstone, coarse grayish-white, most probably equivalent to one often found in Greene Co., Pa., 100' below the Waynesburg coal. It caps the summit of Westernport hill.....	25' 0''	} Upper Coal Measures.					
2. Mostly concealed, but showing some outcrops of flaggy sandstone and shale.....	130' 0''						
3. <i>Coal blossom</i> , large, Sewickley?.....	—						
4. Concealed.....	90' 0''						
5. Shale, grayish.....	2' 0''						
6. <span style="display: inline-block; transform: rotate(-90deg); font-size: small; vertical-align: middle;">Pittsburgh Coal at Franklin Co.'s new opening, Westernport Hill.</span>	<table border="0"> <tr> <td><i>Coal</i>, impure .. 0' 8''</td> <td rowspan="4">} Roof coal.. 6' 8''</td> </tr> <tr> <td>Dark slate.... 4' 0''</td> </tr> <tr> <td><i>Coal</i>, slaty .... 1' 0''</td> </tr> <tr> <td>Shale, grayish . 1' 0''</td> </tr> </table>	<i>Coal</i> , impure .. 0' 8''	} Roof coal.. 6' 8''	Dark slate.... 4' 0''	<i>Coal</i> , slaty .... 1' 0''	Shale, grayish . 1' 0''	} 19' 8''
		<i>Coal</i> , impure .. 0' 8''		} Roof coal.. 6' 8''			
	Dark slate.... 4' 0''						
	<i>Coal</i> , slaty .... 1' 0''						
	Shale, grayish . 1' 0''						
	<i>Coal</i> , main bench, no partings, all good 10' 0''						
	Slate..... 0' 2''	} Bottom coal 3' 0''					
<i>Coal</i> , good .... 0' 10''							
Parting..... 0'' - ¼''							
<i>Coal</i> , not mined 2' 0''							
7. Dark slate.....	0' 6''	} Barrens.					
8. Soft carbonaceous shale.....	0' 2''						
9. Shales, drab .....	15' 0''						
10. Sandstone, flaggy, and shaly .....	25' 0''						
11. Concealed .....	140' 0''						
12. <i>Coal</i> , blossom. <i>Elk Lick</i> ?.....	—						
13. Concealed.....	100' 0''						
14. <i>Coal</i> , blossom .....	—						
15. Concealed.....	140' 0''						
16. <i>Coal</i> .....	4' 0''						
17. Concealed.....	35' 0''						
18. Sandstone, massive, pebbly. Upper Mahoning.....	30' 0''						
19. Concealed, with a <i>coal</i> reported 4' thick just below top of the interval.....	90' 0''						
20. Lower Mahoning S. S., massive, visible.....	20' 0''						
21. Concealed.....	10' 0''						
22. <i>Coal</i> , <i>Upper Freeport</i> .... { <i>Coal</i> ..... 2' 0'' } Mr. Spangler's opening, { Shale, gray.. 1' 0'' }.... Westernport hill. { <i>Coal</i> ..... 2' 0'' }	5' 0''						
23. Concealed .....	10' 0''						

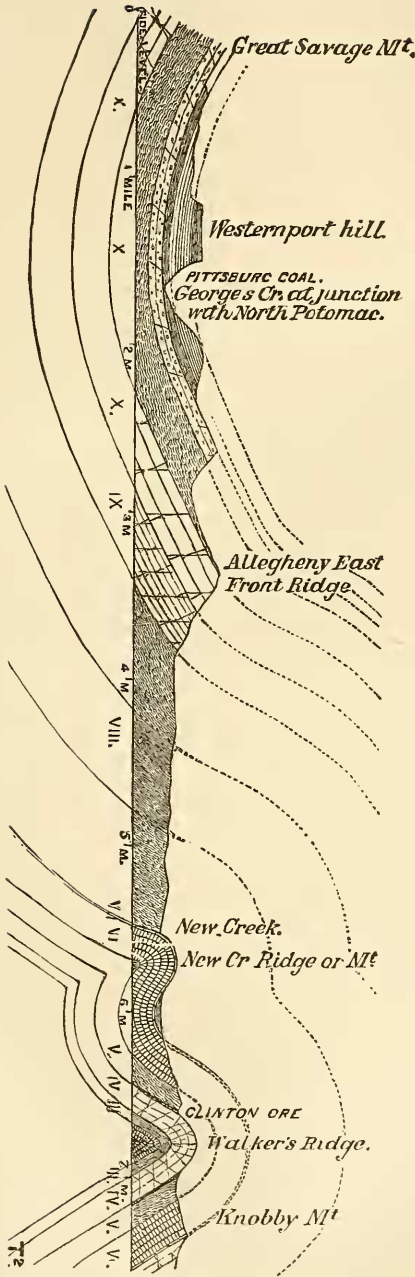
24. Shale, bluish .....	10' 0''	Lower Productive		
25. Coal .....	2' 6''			
26. Fireclay .....	2' 0''			
27. Concealed .....	10' 0''			
28. Sandstone, very hard .....	2' 0''			
29. " shaly .....	5' 0''			
30. Shales, sandstone and concealed .....	55' 0''			
31. Dark bituminous shales .....	5' 0''			
32. Coal, visible .....	2' 0''			
33. Dark shales and concealed .....	10' 0''			
34. Very massive sandstone, Lower Freeport .....	50' 0''			
35. Shales, drab .....	0'-5' 0''			
36. Coal { Middle Kittanning } { Coal, slaty ... 1' 0'' }	5' 6½''		Coal Measures.	
{ Darlington . . . . . }				{ Bony coal... 0' 8'' }
Mr. Spangler's opening in				{ Coal, pyritous 1' 4'' }
Westernport hill.		{ Slate, hard... 0' ½'' }		
{ Coal, best... 2' 6'' }				
37. Fireclay, very sandy .....	3' 0''			
38. Shales with nodular <i>iron ore</i> .....	2' 0''			
39. Fireclay, impure .....	4' 0''			
40. Flaggy sandstone .....	20' 0''			
41. Concealed .....	25' 0''			
42. Fireclay, very sandy and impure .....	10' 0''			
43. Flaggy sandstone .....	10' 0''			
44. Sandy shales .....	15' 0''			
45. Massive sandstone { Piedmont } .....	20' 0''			
{ Homewood }				
46. Coal .....	2' 0''			
47. Dark shales, containing many fossil plants, <i>Pecopteris dentata</i> , <i>P. polymorpha</i> , <i>Neuropteris flexuosa</i> , <i>N. acutifolia</i> , <i>Odontopteris</i> sp.? and many other common <i>Coal measure</i> forms; also many nodules of "Kidney" <i>iron ore</i> , all seen in cutting at Davis's bridge (Saw mill road) opposite Piedmont .....	45'			
48. Sandstone, hard, somewhat current bedded, inclined to be flaggy, weathering in holes, seen in cliff to level of North Potomac, at Piedmont, just above the C. & P. R. R. bridge .....	40' 0''	No. XII, or Conglomerate		
49. Dark shales (coaly) and concealed .....	30' 0''			
50. Sandstone, flaggy .....	10' 0''			
51. Shale, dark olive .....	2' 0''			
52. Coal .....	1' 6''			
53. Fireclay, dark, sandy .....	12' 0''			
54. Sandstone, flaggy, with <i>coal streaks</i> .....	10' 0''			
55. Coal .....	1' 6''			
56. Shale with nodular <i>iron ore</i> .....	2' 0''			
57. Shales and flaggy sandstone .....	40' 0''			

268'

451'

<p>58. Massive, very hard, grayish-white fine grained sandstone, with some small pebbles, exhibiting in its lower portion between the layers, at intervals of 2' to 3' a kind of imperfect crystallization, by which a vertical section through the layers much resembles along the bedding planes the large interlocking teeth of an animal. This peculiar structure was observed at localities 2 ms. distant, and seems to be characteristic of this stratum in the Piedmont region. Seen forming a long line of cliffs on the Maryland side of the Potomac, 1 mile below Piedmont, and also capping the summit of the Front Ridge Allegheny on the W. Va. side, 2 ms. below Piedmont.....</p>	<p>45' 0''</p>	<p>Measures.</p>
<p>59. <i>Coal shale</i> .....</p>	<p>5' 0''</p>	
<p>60. Concealed with some shale and flaggy S. S. visible... ..</p>	<p>145' 0''</p>	<p>Imbral (No. XI).</p>
<p>61. Sandstone, massive.....</p>	<p>10' 0''</p>	
<p>62. Bituminous shale.....</p>	<p>10' 0''</p>	<p>852'</p>
<p>63. Sandstone, flaggy.....</p>	<p>10' 0''</p>	
<p>64. Sandstone, massive, whitish (base of XII).....</p>	<p>20' 0''</p>	<p>or Mauch Chunk Shales. Mountain Lime</p>
<p>65. <i>Coal</i>, seen at roadside along the Maryland shore of North Potomac, 1 m. below Piedmont.....</p>	<p>1' 0''</p>	
<p>66. Sandstone, drab.....</p>	<p>4' 0''</p>	<p>852'</p>
<p>67. Fireclay and shale.....</p>	<p>3' 0''</p>	
<p>68. Sandy shale.....</p>	<p>4' 0''</p>	<p>852'</p>
<p>69. Shales, brown, containing <i>iron ore</i>.....</p>	<p>10' 0''</p>	
<p>70. <i>Red shale</i>.....</p>	<p>10' 0''</p>	<p>852'</p>
<p>71. Sandstone, flaggy, greenish-gray, with much shale... ..</p>	<p>40' 0''</p>	
<p>72. Concealed.....</p>	<p>40' 0''</p>	<p>852'</p>
<p>73. Sandstone, somewhat massive, greenish-gray.....</p>	<p>20' 0''</p>	
<p>74. Concealed, but showing occasional appearances of <i>red shale</i>, and very probably largely composed of that material.....</p>	<p>375' 0''</p>	<p>852'</p>
<p>75. Sandstone, somewhat massive, but often inclined to be flaggy, greenish-gray; seen in cliffs along the B. &amp; O. R. R. cuts, near the 205th mile post from Baltimore, below Piedmont.....</p>	<p>130' 0''</p>	
<p>76. <i>Red shales</i>.....</p>	<p>35' 0''</p>	<p>852'</p>
<p>77. Shales, greenish, sandy.....</p>	<p>20' 0''</p>	
<p>78. <i>Red shale</i> to level of B. &amp; O. R. R. track at little run 76 rods east from the 205th m. p. from Baltimore... ..</p>	<p>10' 0''</p>	<p>852'</p>
<p>79. Concealed.....</p>	<p>150' 0''</p>	
<p>80. Limestone, gray, fossiliferous, containing <i>Spirifer keokuk</i>, <i>Athyris sub-quadrata</i>, <i>Productus cora</i>, <i>Hemipronites crassus</i>, and many <i>Crinoidal</i> fragments....</p>	<p>10' 0''</p>	<p>852'</p>
<p>81. Concealed, but probably containing several layers of limestone.....</p>	<p>90' 0''</p>	
<p>82. Limestone, gray, massive.....</p>	<p>5' 0''</p>	<p>852'</p>
<p>82. Limestone, gray, massive.....</p>	<p>5' 0''</p>	

*Section from the eastern escarpment of Savage Mt through Westernport (Md.) hill crossing to the W. Va. side of the North Potomac at the mouth of Georges Creek, and continuing along the same S.25.E. to the summit of Knobby Mt. Scale 6000' to an Inch.*



*Second Geological Survey of Pennsylvania.*

*Constructed May 1881 by Prof. I. C. White.*



- 83. *Red shales* and concealed..... 140' 0''
  - 84. Sandstone, coarse, brownish, visible ..... 5' 0''
  - 85. Concealed ..... 50' 0''
  - 86. Limestone, grayish-white, no fossils seen..... 10' 0''
  - 87. *Silicious Limestone* (of Stevenson in Fayette and Westmoreland, Pa.), exhibiting a wavy or current bedded structure and giving forth a metallic resonance when struck with hammer..... 30' 0''
- } 340'  
stone (No. XI.)
- 88. *Vespertine, Pocono, or No. X*, consisting of gray, current bedded, mostly flaggy sandstones, no conglomerates seen, nor red shales; rising at an angle of 18°—20° towards the S. E. and extending along the B. & O. R. R. for 58 chains, the lowest layers rising above R. R. level 33 chains east from the 204th Baltimore m. p. Thickness, about.....1150'
  - 89. *Catskill, or No. IX*, consisting of dark red shales alternating with red, and greenish-gray sandstones, containing *fish remains*, but no molluscan seen; rising towards the S. E. at an angle of 25° at top and 35° where the bottom layers come up 7 chains west of the 203d m. p. thus making a vertical thickness of, say.....1300'
- 90. *Chemung*, consisting of alternate layers of thin, olive sandstones, and shales, very fossiliferous, and perfectly exposed along the B. & O. R. R. in vicinity of 203d m. p.; coming up towards the S. E. at an angle of 35°, and at the end of 10½ chains the dip is increased to 45°, thus giving an approximate thickness of Chemung down to this point of about.....400'
  - 91. *Conglomerate*, composed of very thin, flat, rounded quartz pebbles, in a matrix of coarse rotten sand with numerous fossil shells imbedded, very forcibly reminding one of the Venango Lower (3d) Oil Sand; thickness..... 2'
  - 92. Chemung flaggy sandstones and shales continue rising at an angle of 45° for 16 rods further towards the S. E. all perfectly exposed, and very fossiliferous; thickness about.....200'
- } Rocks certainly  
Chemung.
- 93. Concealed, 13½ chains, at the end of which the strata are rising at an angle of 62° towards the S. E. thus making the intervening rock thickness about..... 700'
  - 94. *Conglomerate*, a gray, hard sandstone, containing numerous layers filled with flattish, white quartz pebbles..... 40'
  - 95. As we go S. E. from this point toward Keyser, the rocks rapidly increase their dip to the N. W. and at ½ mile from the outcrop of No. 94, are vertical; continuing thus or even slightly bent over beyond the perpendicular to the end of 100 chains (1¼ ms) from No. 94. Exposures are rare in this interval, as there are



seldom more than 5'—10' exposed at any one locality, and these are in every case olive, and drab colored shales. The topography also shows that no hard nor massive rocks occur in this interval, since on entering it the mountain immediately breaks down to the S. E., giving a broad valley along the Potomac, bordered by gently sloping hillocks. The interval includes all the rest of No. VIII, whatever there may be of *Portage*, *Hamilton* and *Corniferous*, and its thickness cannot be less than.....6000'

96. *Oriskany Sandstone* (No. VII), rises above the North Potomac nearly opposite the dèpôt at Keyser, and arching up over New Creek ridge (mountain) forms the bold cliff at Queen's point, opposite Keyser, 400' almost vertically above the river; a very coarse, brownish sandstone, filled with its characteristic fossils, *Spirifer arenosus*, *Rensselaeria ovoides* and *Platyceras ventricosum*; it comes down to the river at the R.R. cut a short distance east from Keyser, with a strong south-east dip, but immediately returning it comes up again with a strong N. W. dip (65°), and arching up passes in the air over the next anticline to come down again along the (monoclinial) crest of Knobby mountain ("Knobbly"). Thickness..... 75'
97. *Lower Helderburg* (No. VI); at top a gray silicious limestone, with several layers of flint 6"—10" thick, interstratified for about 150', then follow blue and gray layers of pure limestone richly fossiliferous, *Strophomena radiata*, *S. rugosa*, *Pentamerus pseudo-galeatus*, *Rhynchonella ventricosa*, *Spirifer macropleurus*, *Atrypa reticularis*, *Tentaculites ornatus*, *Lepeditia alta*, besides numerous species of *Favosites*, *Zaphrentis*, *Stromatopora*, and *Chatetes*, being very abundant. Very fine *Trilobites* are also reported from some of the quarries, which from their (reported) size must be species of *Asaphus*. This is the limestone which was identified in H. G. Jones's section as the *Lower Mountain Limestone* of XI, and 440' thick. My measurements make it much thicker, however; it is finely exposed along Limestone run one-half mile S. E. from Keyser; it makes the N. W. slope of Knobby mountain all the way between Keyser and Cumberland, the upper silicious layers often forming the irregular crest of the same; its uppermost 300' are also exposed under the great arch of Oriskany Sandstone at Queen's point opposite Keyser, where the North Potomac cuts through New Creek mountain. The fossils given were all seen in the upper portion of the formation. No attempt was made to subdivide the series, which consists of limestone throughout, the measurement of which south-eastward along Limestone run gave the horizontal distance through it 18 chains, with a N. W. dip of 63°, which would give a thickness of.....1050'